Put Some High Energy in Your Papers!

The High-Energy Universe

High-energy astronomy is central to the study of the most interesting phenomena in modern astrophysics. Now, tapping into the wealth of high-energy data is easy.

The HEASARC - The High Energy Astronomy Science Archive Research Center - is NASA s primary archive for data in the far UV, X-ray and gamma-ray regimes. This archive uses existing community standards like FITS to deliver data from over 20 past and current high-energy missions, such as ROSAT, RXTE and soon Chandra and XMM.

Where can high-energy data take you? High-energy emission from black holes and neutron stars reveals the physics of the innermost regions of accretions disks. The evolution and structure of clusters of galaxies is reflected in their diffuse X-ray images. The interstellar medium from the entire Galaxy can be mapped using gamma rays. Supernovae, interacting binaries, AGN, atmospheres of normal stars... These are just a few of the objects that reveal crucial information in the high-energy domain.

This brochure describes services and resources available at the HEASARC. The HEASARC mission supports the entire astronomical community, with resources designed to facilitate all researchers, not just x-ray and gamma-ray specialists. HEASARC archival services, Web tools, software, and personnel are all dedicated to supporting the broadest use of high-energy astronomy data.

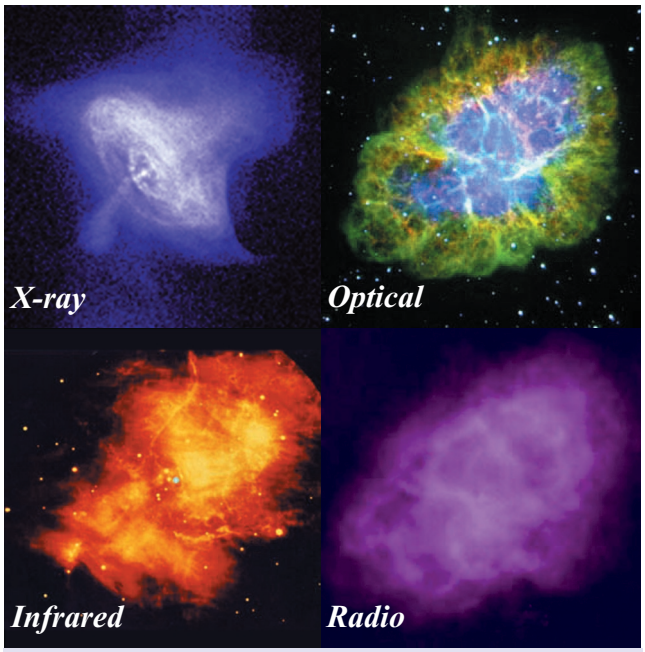
COSMIC JOURNEYS
REACHING FOR THE STARS

HEASARC

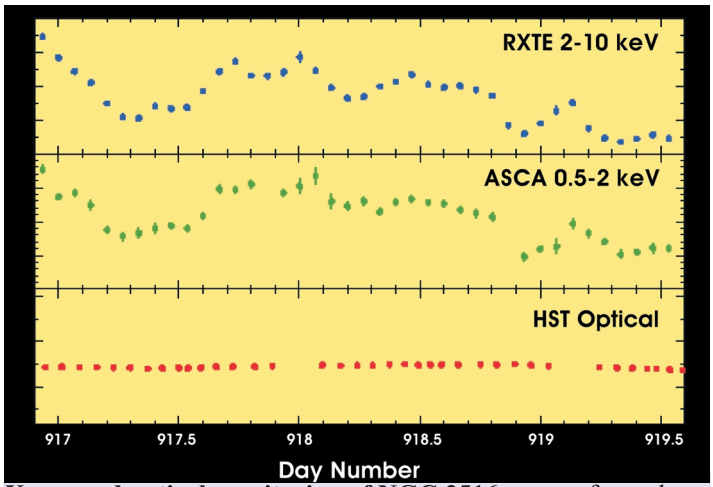
HEASARC Overview

The HEASARC was established in November 1990 in the Laboratory for High Energy Astrophysics at NASA's Goddard Space Flight Center with a charter to support high-energy astronomy in all phases of research: data browsing, proposal writing, observing, analysis, and data correlation. From its inception, the HEASARC has taken a multi-mission approach, with the same software tools and interfaces used for different missions.

The HEASARC archive is used extensively by the high-energy community and is comprised of 1.6 Terabytes of compressed data. Current retrievals are about 160 gigabytes each month. New data is added at a rate over 1 gigabyte each day. These rates will increase substantially in the next few years.



The Multiwavelength Crab Nebula



X-ray and optical monitoring of NGC 3516 was performed with RXTE, ASCA and HST. The X-ray variations were very strong, while the optical showed small but significant variability. No simple relation between the X-ray and optical variations could be determined. The failure to observe an X-ray/optical correlation or lags between optical bands in this experiment presents difficulties for the reprocessing model, in which a central X-ray source illuminates a stratified disk (with the hottest regions closest to the central energy source) which absorbs and then thermally reradiates the energy at longer wavelengths.

HEASARC Resources

The HEASARC provides many services and tools for archival and general astronomical research. Some of these are detailed in the following pages. Core HEASARC resources include:

¥The ***SkyView*** and **Astrobrowse** services get images or remote Web resources for a given region in the sky. Astronomers can easily compare high-energy results with data from other regimes.

¥The **W3Browse** interface to the HEASARC catalogs and archives lets a user browse and retrieve data from the archive by querying for targets or observations according to astronomical or observational criteria of the user s choosing.

¥The **FTOOLS** and **XANADU** software packages provide a complete and portable set of tools for analysis of high-energy data.

¥The **Remote Proposal System** (RPS) and **Argus** allow users to propose for and track observations with different observatories using simple common interfaces.

How Do I...?

...Get the X-ray flux of my favorite object?
Use the W3Browse service to search for your object in X-ray object catalogs. The X-ray master catalog may be particularly apropos.
http://heasarc.gsfc.nasa.gov/W3Browse/

...Convert X-ray flux/energy/etc units to those used in my field?
Our W3PIMMS service can convert from the arcane units used in some X-ray papers (and a few of our catalogs) to more standard units.
http://heasarc.gsfc.nasa.gov/Tools/w3pimms.html
A general energy converter also helps translate energy units.
http://heasarc.gsfc.nasa.gov/cgi-bin/Tools/energyconv/energyConv.pl

...Find out which X-ray satellites have looked at my favorite source?
You can use W3Browse to search observation catalogs for individual satellites, or the basic interface can search all of the satellites for which we have archival data in a single step.
http://heasarc.gsfc.nasa.gov/W3Browse/

...Find and download data from the HEASARC?
The HEASARC's W3Browse service helps you find data by astronomical criteria and will help you create a tar file of interesting data. If you already know the structure of our archive you can get all data directly through FTP.
http://heasarc.gsfc.nasa.gov/W3Browse/
ftp://legacy.gsfc.nasa.gov/

...Figure out which satellite can do the science I'm interested in?
The HEASARC maintains extensive documentation for each mission
http://heasarc.gsfc.nasa.gov/docs/corp/observatories.html
and has a number of tables which compare capabilities, e.g.
http://heasarc.gsfc.nasa.gov/docs/heasarc/missions/comparison.html

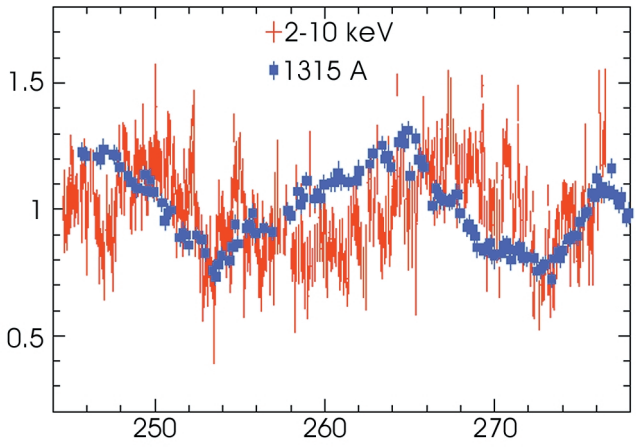
...Find teaching resources for my high school or college course?
The HEASARC's outreach programs provide many free educational resources for all levels.
http://heasarc.gsfc.nasa.gov/docs/objects/
http://heasarc.gsfc.nasa.gov/Images/
http://imagine.gsfc.nasa.gov/

...Do anything with these 'event lists'?
High-energy instruments often count individual photon 'events'. To create the maps or time-series with which you may be more familiar, use our FTOOLS package.
http://heasarc.gsfc.nasa.gov/docs/software/ftools/ftools_menu.html
Many of our high-level software tools will do this for you automatically!
http://heasarc.gsfc.nasa.gov/docs/corp/software.html

...Analyze data?
The HEASARC's XANADU package supports spectral, temporal and spatial analysis of high-energy data and has been developed to be quite portable. You can use this immediately on the high-level products in the HEASARC archive.
http://heasarc.gsfc.nasa.gov/docs/xanadu/xanadu.html
The FTOOLS provide more discrete analysis tools including mission specific analysis pipelines.
http://heasarc.gsfc.nasa.gov/docs/software/ftools/ftools_menu.html

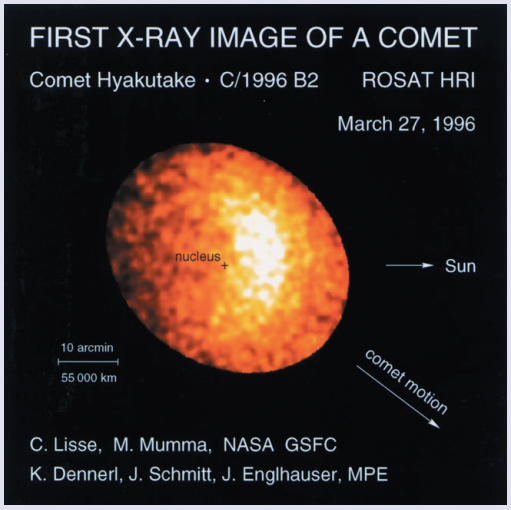
Your most frequently asked questions - ANSWERED!

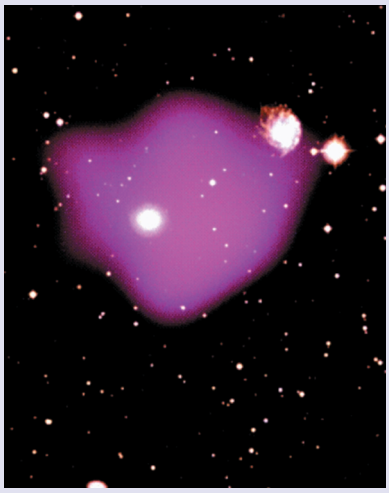
Simultaneous X-ray and UV data show that AGN emission models need revision



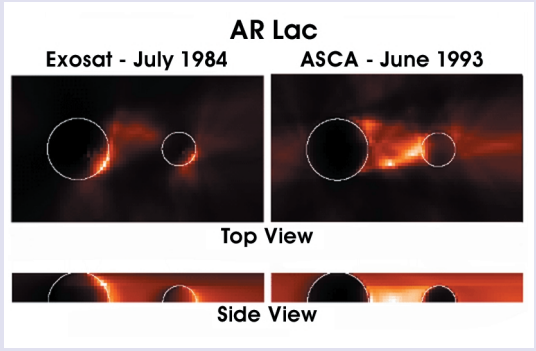
Above: A near-continuous monitoring campaign of the Seyfert 1 galaxy NGC 7469 was undertaken in the **X-ray with RXTE**, investigating time scales from hours to one month. Simultaneous monitoring was performed in the **UV with IUE**, making this the most intensive X-ray/UV variability study performed for an active galaxy. The UV and X-ray light curves show amplitude variations of similar magnitude, but are not strongly correlated at zero lag time. While the maxima in the UV light curve appear to precede those in the X-ray by ~4 d, the minima of the light curves are near-simultaneous. This implies that models of the continuum emission of AGN which invoke simple UV re-radiation of X-ray photons, as well as models in which the X-ray are produced solely by Compton upscattering of UV radiation, must be revised. Two variability mechanisms which have no simple relationship are required to explain the observed UV/X-ray variability.

HEASARC Software and Tools





ROSAT observes hot gas in the small galaxy group NCG2300.



These images show the results of a deconvolution of the ASCA lightcurve taken of the 2 day RS CVn binary AR Lac and compared with a similar deconvolution of an EXOSAT lightcurve taken 9 yr earlier. The distribution of coronal material in the system can be seen. A large structure seems to join the two stars in the ASCA observation, which was less obvious 9 yr earlier.

W3Browse

http://heasarc.gsfc.nasa.gov/W3Browse/

W3Browse is the primary method to access the catalogs and archives of the HEASARC. Catalogs from all astronomical regimes, with an emphasis on high-energy astrophysics satellites are available.

W3Browse comprises several levels of Web pages. structured in layers starting from the launch page which provide successively more detailed access to the information resources of the HEASARC. It allows the user to select missions and targets, based on coordinates, object name, or other parameters. Users can retrieve information on observations. Selected data can be subsequently browsed and retrieved either individually or merged with other data into a single tar file.

SkyView

http://skyview.gsfc.nasa.gov/

SkyView is a Virtual Observatory on the Web. Users can generate images of any portion of the sky at wavelengths in all regimes from radio to gamma-ray. Users tell *SkyView* the position, scale and orientation desired, and *SkyView* gives users an image made to their specification. The user need not worry about transforming between equinoxes, coordinate systems, or rotating the image,.... *SkyView* handles these geometric issues and lets the user get started on astronomy.

Astrobrowse

http://heasarc.gsfc.nasa.gov/ab/

The Astrobrowse service allows users to query hundreds of different catalogs and services around the world using a single form.

Software

http://heasarc.gsfc.nasa.gov/xanadu/

FTOOLS are a collection of utility programs used to create, examine, or modify the contents of FITS data files. There are also user friendly GUI tools which allow interactive browsing of FITS files and provide a more intuitive interface for running the FTOOLS. The FTOOLS package forms the core of the HEASARC software system for reducing and analyzing data in the FITS format.

The **XANADU** software package comprises high-level, multi-mission tasks for X-ray astronomical spectral (XSPEC), timing (XRONOS) and imaging (XIMAGE) data analysis.

Argus

http://heasarc.gsfc.nasa.gov/argus/

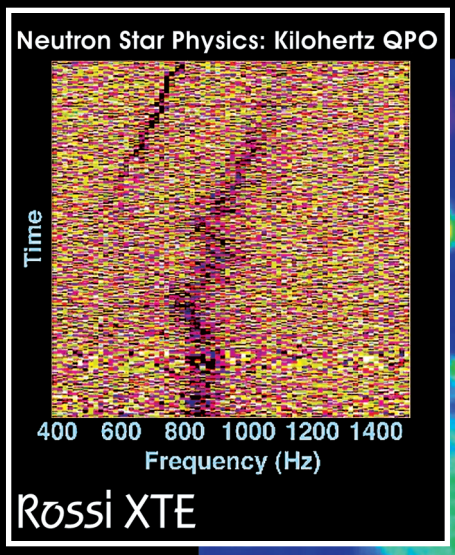
Argus is an interactive World Wide Web service provided by the HEASARC that tracks the status of proposals from acceptance through ingest into the archival for the ASCA, Astro-E, CGRO, RXTE missions.

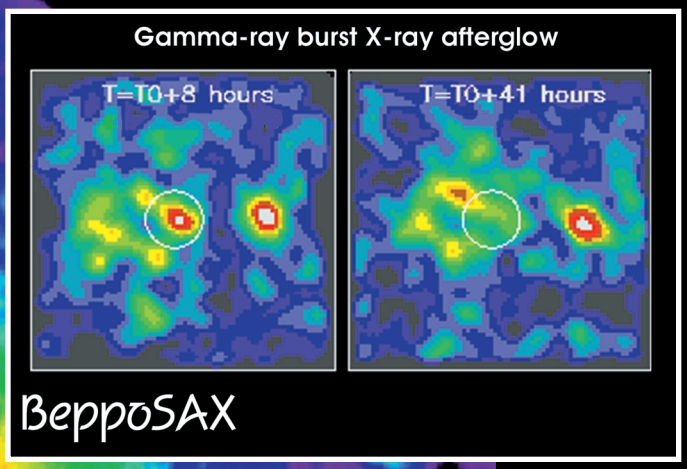
Tools

http://heasarc.gsfc.nasa.gov/Tools/

The HEASARC provides tools to aid users in planning for missions, proposing observations and simulating data. These tools allow a user to find an interesting object in the scientific literature, (Bibliography), or find the coordinates of an astronomical object in may different formats (CoCo), discover when that object is visible to a particular satellite (Viewing), find the neutral hydrogen column density for that area of the sky (W3nH), find the estimated count rate or flux for that object based on previous observations (W3Pimms) or simulate a spectrum of the source (WebSpec).

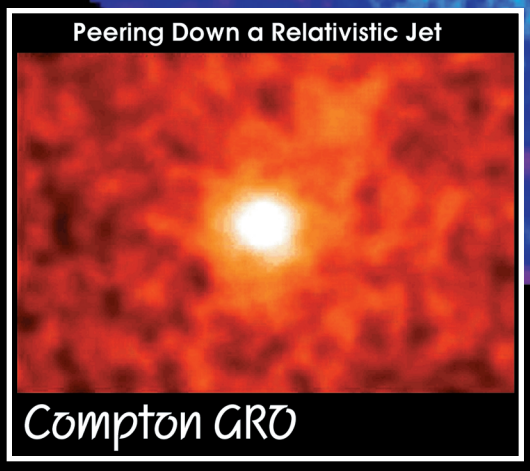
The Extreme Universe

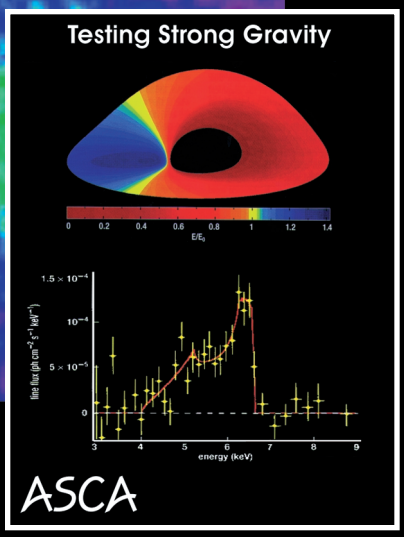




Clusters of Galaxies
Biggest Objects in the Universe

ROSAT





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